

II-010

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July 25, 1997

CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, California 95814

Subject: RFP - Due July 28, 1997

Enclosed please find ten (10) copies of our Inquiry Submittal covering "Alternative Energy Powered Flotation Fish Screen Cleaner" and attachment entitled "Suisun Marsh Mitigation Lands Project".

We would be pleased to answer any questions and look forward toward your response.

Thank you for your consideration of our Inquiry Submittal.

Very truly yours,

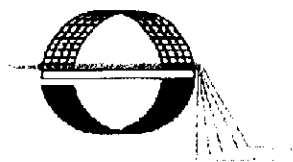

JAMES J. STRONG

JJS:mk

Enclosures

DWR WAREHOUSE

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Inquiry Submittal

Alternative Energy Powered Flotation Fish Screen Cleaner

Many water diversion projects that utilize culverts, irrigation ditches, or other passages to divert water for irrigation or wetlands water management were constructed forty or more years ago, and did not include fish screens. Installation of suitable fish screens at these diversions would prevent entrainment of fish into improper environments and maintain them in their natural environment.

In order to retrofit these diversions with fish screens where electricity is not available, there was no alternative in the past but to size the fish screens on the basis of California Department of Fish and Game criteria for non-continuously cleaned screens; i.e., six square feet per cfs of flow. Given that the material used in these fish screens is relatively expensive, and the screen area involved can be significant, there is obviously a great benefit in providing a means of continuously cleaning the fish screens utilizing alternative energy because substantially less screen area is required; i.e., 1-1/2 square feet per cfs of flow. There clearly exists a need for a method to continuously clean fish screens at remote locations where conventional electricity is not available that involves an inexpensive apparatus which is simple to install and will operate reliably with low maintenance.

One such type of apparatus suitable for these applications would involve a wiper or brush attached to a flotation device to continuously clean the fish screen. The operation of the apparatus would be capable of utilizing available and renewable energy such as tidal influx, solar, or wind power. Where tidal fluctuations may involve culverts larger than 30 inches in diameter, as well as for use with several culverts in a row, a "stand alone" pre-fabricated steel or other frame structure incorporating flat fish screen panels can be mounted on driven steel pilings, or on a concrete base, in front of the culvert. Each flat fish screen panel would incorporate a flotation device [e.g. a rectangular flotation chamber three feet to five feet wide, by approximately six inches in height] upon which the screen cleaning brushes or wipers are mounted. The flotation chamber would be contained within a vertical guide assembly on either side of the fish screen panel.

Alternative energy [tidal influx, solar, or wind] would drive an air compressor to provide pressurized air to a receiver tank. As air is transferred from the receiver to the float chamber at the bottom of the screen panel, water is displaced creating an upward force which drives the attached brushes up the screen until a valve stop is reached at the top end of the frame structure. When the chamber hits this stop, air is released and the chamber and cleaning brushes sink to the base of the screen panels, at which point an air valve

closes, and the cycle repeats itself. Each screen panel may be cleaned sequentially by this vertical wiping action.

This Inquiry Submittal is offered to request whether this alternative energy powered flotation fish screen cleaner system is of interest, and if so, to request identification of specific locations for installing the apparatus within the CALFED Bay-Delta Program to evaluate the effectiveness of this approach.

Aquadyne, Incorporated would construct the apparatus and be the lead program manager. Aquadyne, Incorporated has been manufacturing screens for fish protection since 1982 with the last project as described in the enclosed paper "Suisun Marsh Mitigation Lands Project".

SUISUN MARSH MITIGATION LANDS **PROJECT**

Faizi Pourhosseini* Frank Wernette** James J. Strong***

ABSTRACT

In order to mitigate loss of wetlands in the San Francisco Bay-Delta Region of California, an area in the Suisun Marsh region is being reclaimed by the California Department of Fish and Game. To accomplish this, the California Division of State Architect has designed the Suisun Marsh Mitigation Lands Project which involves development of 354 acres of wetland habitat in the Island Slough Unit of the Grizzly Island Wildlife Area, in Suisun Bay, Solano County, California. The project involves construction of a water intake structure, water conveyance channels, perimeter and field levees, and other structures. These structures will establish seven separate fields within the Island Slough Unit to control water in-flows and out-flows for wetland habitat enhancement and management.

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INTRODUCTION

Description of the Suisun Marsh

The Suisun Marsh is the largest brackish water marsh preserve in the Western United States with 85,000 acres of tidal flats and marshland adjacent to Suisun Bay which is part of the San Francisco Bay-Delta Region of California. [Figure 1] The Suisun Marsh has been naturally divided into islands by a series of channels or sloughs. These sloughs flow north from Suisun Bay winding their way throughout the Suisun Marsh. Runoff from the Sacramento and San Joaquin River watersheds are carried into the marsh and these tributaries, as well as slightly lower land elevations, help to create the Suisun Marsh.

The Suisun Marsh is basically a brackish marsh. Fresh water from the Sacramento and San Joaquin rivers flows into the marsh by way of Suisun Bay in amounts that vary depending on the season and amount of annual rainfall. These fresh water flows are mixed tidally with salt water from the San Francisco Bay.

The privately managed wetlands in the Suisun Marsh are overseen and protected by the Suisun Resource Conservation District, while state lands are managed by the California Department of Fish and Game. Both agencies seek to preserve the ecological balance of plants and wildlife in the area by limiting the use and development of the land to several uses. Currently, the widest use of the land is for duck and pheasant hunting with over 100 active duck clubs in the area. Secondary uses include cattle and sheep grazing with some agriculture; however, the presence of salt water on the land and the deficiency of the sandy clay and loam soils to support crops severely restricts agricultural activity.

Island Slough Wetland Development Project

The Island Slough Unit of the Suisun Marsh is located within the Grizzly Island Wildlife Area which consists of nearly 13,000 acres. This area is managed by the California Department of Fish and Game primarily to provide wintering habitat for migratory waterfowl, and other resident and migratory species. [Figure 2] The principal objective of the Suisun Marsh Mitigation Lands Project is to fulfill a contractual obligation between the California Department of Fish and Game and the California Department of Water Resources and the U. S. Bureau of Reclamation to acquire, develop, and maintain the 354 acres of wetland habitat comprising the Island Slough Unit to offset impacts associated with construction of existing as well as future water delivery systems throughout the Suisun Marsh in addition to general degradation of waterfowl habitat on the Channel Islands located in Suisun Bay.

Within the 354 acre Island Slough Unit, 254 acres are being developed and managed as seasonal wetland habitat to provide optimal food and nesting cover for ducks, pheasants, ground nesting hawks and owls, as well as other wildlife species. The remaining 100 acres are being developed and managed as pickleweed habitat for the endangered salt marsh harvest mouse to compensate for the loss of similar habitat.

As shown in Figure 3, the project involves the installation of a new water intake structure, construction of and improvements to new and existing levees, excavation of water supply channels, improvements to existing drain facilities, and installation of pond intake and outlet structures.

Prior to California Department of Fish and Game's acquisition of the 354 acres in 1990, the Island Slough Unit was previously managed as a private pheasant hunting club with some seasonal cattle grazing. Some water management and flood control was accomplished with two 15 HP pumping stations and outlet pipes under Grizzly Island Road with discharge to Montezuma Slough. The fields received water directly from rainfall, and were generally inundated during the winter.

The Suisun Marsh Mitigation Lands Project divided the 354 acres of the Island Slough Unit into seven separate fields separated by levees and ditches for purposes of conversion from upland plant communities to wetland plant communities and open water. [Figure 3] Cattle grazing will be excluded from the area.

Water management will include two leach cycles in the late winter and early spring to encourage the growth of alkali bulrush, or just one leach cycle in the late winter to encourage the growth of fat hen. Combinations and/or minor variations of these water management schedules for fields 1 through 6 are expected to result in the establishment of more productive and diverse wetland plant communities than are currently found in this area. In addition, it is anticipated that the enhancement habitat will provide a greater diversity of wildlife species. Field 7 will be managed differently than fields 1 through 6 to encourage the growth of pickleweed as potential habitat for the endangered salt marsh harvest mouse.

Once firmly established, the California Department of Fish and Game plans to manage the land for wildlife conservation but people will not be excluded. CDF&G plans to implement a public hunting program for both waterfowl and upland game; but human impacts will be carefully controlled to protect and conserve the native wildlife and vegetation.

FISH SCREEN STRUCTURE

The water diversion for the Suisun Marsh Mitigation Lands Project is located at the wetlands main intake on Montezuma Slough. [Figure 3] Inasmuch as the screen is installed in a tidal system, the approach velocity had to be evaluated at one-foot intervals from the highest tide to the lowest low water that would result in water diverted through the intake facility. For this particular site, the criteria governing approach velocity is a maximum of 0.2 ft./sec. for the protection of delta Smelt, a State and Federally threatened fish. The maximum capacity of water flow through the intake facility is 33 cu. ft./sec. which occurs at high tide; therefore, a minimum of 165 sq. ft. of total screen surface area was required when the entire screen surface area was totally inundated and diversion rates at peak flow. At lower tides, diversions will likewise occur, but with a correspondingly smaller percentage of the total screen surface area inundated. Under these conditions, it was still required to maintain less than the maximum velocity of 0.2 ft./sec. .

The diversion point on Montezuma Slough is rather shallow at approximately five feet between mean high water and mean low water. This shallow depth precluded the use of conventional cylindrical "TEE" configuration fish screens. Flat screen panels, therefore, appeared to be the logical choice for the fish screen. In addition, flat screen panels had been installed nearby at the California Department of Water Resources' Roaring River facility constructed about 15 years ago. Rather than a costly concrete structure, which was utilized at the Roaring River facility, it was decided that the Suisun Marsh Mitigation Lands project intake screen structure would utilize a cost-effective pre-engineered, pre-fabricated steel structure designed by a single manufacturer

having prime responsibility for the performance of the system.

The fish screen structure as shown in Figure 4 was designed to be self-supporting and provided with means for mounting to four pile supports for simplicity of field installation. The structure was constructed of mild steel which was sandblasted to remove mill scale and then coated with coal tar epoxy paint.

The seven 60" by 60" screen panels slide into guides for manually raising individual screen panels for removal, repair, and out of water storage during non-diversion periods. The intake screen material is AISI Type 316 Stainless Steel of all welded construction having slotted openings to provide maximum open area with corresponding strength requirements. The slots are formed from profile wire having a wedge shape so that the slots are wider traveling inwardly from the screen surface to minimize the chance of debris becoming clogged in the screen opening. Each screen panel is provided with suitable frame and all panels are interchangeable.

An automatic air burst cleaning system was provided to backflush debris off the screen. The automatic cleaning system consists of air spargers capable of providing air pressure so the debris can be effectively removed from the screen surface during maximum flow periods at least every five minutes which is a California Department of Fish and Game criteria. Ambient lateral flow will remove the debris after backflushing the screen. During slack periods, these currents may not be adequate to assist in either the downstream or upstream removal of debris; however, these periods are expected to be very brief in duration. Sequencing of the air burst spargers may not be necessary during slack periods since flows are reversed four times each day during tidal changes. In place of sequencing of the air burst during these periods, the screens will be visually inspected by the California Department of Fish and Game personnel to evaluate whether these circumstances result in debris collecting to levels that are not carried away following initial backflushing by the air spargers. Should these inspections indicate a concern, sequencing will be evaluated.

California Department of Fish and Game maintenance staff at the Grizzly Island Wildlife Area will be responsible for monitoring the operation of the automatic cleaning device, inspecting the screen plates to verify the screens are being effectively cleaned, and removing any large debris, flotsam or any other material that could hinder screen efficiency. Screen inspections and cleaning, as needed, will occur three times a week during periods when wetlands are being filled, i.e., early October, late January, and early March. After one year, if experience indicates it is appropriate, inspection frequency may be reduced. During other periods of very low intake flow, such as when water is being circulated on flooded wetlands, inspections will occur once per week. Experience gained at the nearby Roaring River fish screen by the California Department of Water Resources [DWR] operations and maintenance personnel will be used in operating the intake screen. For instance, during some seasons and in dry water years, barnacle growth on the screen surfaces have necessitated the vigorous scrubbing of the screen to remove growth. Provisions to accomplish this same type of manual cleaning will also be utilized if similar conditions develop at the Suisun Marsh Mitigation Lands intake structure. U. S. Coast Guard Regulations required the installation of a beacon, which is operated at night and in inclement weather, as well as notification signs warning mariners of a potential hazard related to the fish screen and intake.

SALT MARSH HABITAT MANAGEMENT AND MONITORING

Management activities for the 100 acres of salt marsh harvest mouse habitat will be substantially different from the 254 acres which will be managed for other wildlife. Management will consist of initially flooding Cell 7 [Figure 3] with water from Montezuma Slough during periods of higher water salinity. Water will be allowed to evaporate to increase soil water salinities to a range which favors pickleweed. Pickleweed and fat hen will be expected to invade the cell within two years after establishment of the cell. After one year, the progress of this establishment will be evaluated by DFG and USFWS biologists. Inoculation of the area with fat hen and pickleweed will take place early in the second year if determined to be needed. After vegetation establishment, flooding will only take place for brief periods in mid to late winter and only for the purpose of irrigating the established plant community and maintaining soil water salinities in the optimum ranges for pickleweed and fat hen. Upland areas will be seeded and planted to establish dense escape cover and will not be manipulated further after establishment. Besides seeding with an appropriate grass mix, coyote bush [*Baccharus pilularis*] in containers will be planted.

Following construction of Cell 7, a formal monitoring effort will be conducted to evaluate how suitable dense salt marsh harvest mouse habitat is becoming established and whether the mouse is beginning to use these new areas. DFG biologists assigned with the Grizzly Island Wildlife Area and biologists with the DFG's Bay-Delta and Special Water Projects Division in Stockton will conduct the monitoring.

The criteria for success will be the establishment of vegetation that meets the following criteria by December 1997:

- 90 acres of dense pickleweed or mixed fat hen/pickleweed
- 10 acres of refugia island scattered throughout Cell 7 approximately one foot higher in elevation with the dense plant cover comprised of fat hen, salt grass, and miscellaneous upland grasses.
- levees on west side of Cell 7 with dense upland escape cover, >70% cover with an average cover height of > 10"

Follow-up live trapping will be conducted beginning in the spring of 1997 to evaluate whether mice are beginning to use the site. The goal will be to verify salt marsh harvest mouse occurrence by the winter of 1999.

Should monitoring in early 1998 indicate that the site will not likely meet the vegetative goals described above, the DFG will implement immediate remedial actions. These actions will include altering the area's water management strategies, mechanical manipulation of the area to change the acreage that is available for refugia, seeding, and fertilizing. If live trapping beginning in early 1999 fails to document salt marsh harvest mice use of the site, provisions will be made to relocate mice from existing habitat that is imminently in danger of being destroyed. This relocation will only occur when the habitat in Cell 7 has met the criteria for suitable mouse habitat.

SEASONAL WETLAND MANAGEMENT AND MONITORING

The remaining 254 acres of existing seasonal wetland habitat in cells 1 through 6 will be managed to improve the wetland plant diversity and wildlife values of the Island Slough Unit. Management activities will include routine levee maintenance and pump and water control structure repair. Water management will follow two general management approaches. One will entail two leach cycles in the late winter and early spring pursuant to the alkali bulrush water management schedule and the other just one leach cycle in the late winter pursuant to the fat hen schedule. Combinations and minor variations on these themes will encourage the establishment of a productive diverse wetland plant community which will support a diversity of wildlife species.

Other management activities will include the manipulation of wetland vegetation by mowing and/or discing. Selected upland areas will be periodically burned, disced, and seeded to provide food and nesting cover for ducks, pheasants and ground nesting hawks and owls. Internal ditches and sloughs will be maintained as fish habitat. Criteria provided by the Solano County Mosquito Abatement District [SCMAD] will be followed during management actions to minimize the potential for increasing mosquito abatement problems associated with the new wetland development. The existing annual mosquito abatement mitigation plan for the Grizzly Island Wildlife Area will be modified to add the Island Slough Unit.

A minimum of 20 acres of upland habitat located in cells 1, 3, and 5 will be converted to wetlands. This will be accomplished by removing enough surface soil to reduce the elevation sufficiently to allow 6 to 10 inches of water to cover the area when flooding is complete. This soil will be used on-site to construct small field levees to ensure proper post project water management of the site.

Target plant species are expected to establish themselves through active water management and natural occurrence of seed in the seed bank [Table 1]. Criteria to evaluate whether or not restoration of the 20 acres of upland has been successful will be if greater than 80 percent of the 20 acres where soil is removed has wetland vegetative cover within three years. Based on experience at Grizzly Island Wildlife Area, the DFG believes the area will readily revegetate and success criteria should be reached within three years of project completion.

The monitoring objective for cells 2, 4, and 6 in the Island Slough Unit is to produce optimum habitat for wintering waterfowl particularly puddle ducks. The goal will be to establish habitat by December 1999 that meets criteria such as:

- total ground cover 80-100 percent
- 30-50 percent ground cover of vegetation with height ≥ 18 inches
- 30-50 percent ground cover of vegetation with height $< 12-18$ inches
- Plant composition to include such species as:
 - alkali bulrush
 - brass buttons
 - fat hen
 - swamp timothy
 - smartweed
 - watergrass
- flooding depths will range from 0 to 12 inches over 80 percent of the area

- effective cell water management; i.e., no low areas that fail to drain properly and drainage facilities that effectively drain soil interstices for effective leaching.

DFG personnel from the GIWA and from Stockton will conduct the required surveys beginning in the spring of 1998. If these initial surveys indicate that the goals described above may not be met, interim remedial measures will be taken. These will include measures such as:

- selective planting
- mowing
- discing
- improvements in the internal levee system to provide better water control
- construct additional mosquito ditches to provide for better cell drainage and soil-salt leaching

Staff from the Solano County Mosquito Abatement District [SCMAD] will, as part of their routine monitoring, monitor the Island slough Unit for proper water management and observance of potential mosquito breeding habitat. Should DFG fail to properly design and/or manage the cells and SCMAD staff find excessive mosquito breeding activity, the immediate remedial measures may be the spraying of the offending site at the DFG's expense.

TABLE 1

Plant species expected to propagate on the California Department of Fish and Game's Island Slough Wetland Development Project:

<u>Common Name</u>	<u>Scientific Name</u>
Alkali bulrush	<i>Serpus robustus</i>
Australian saltbush	<i>Atriplex semibaccata</i>
Brass-buttons	<i>Cotula coronopifolia</i>
Baltic rush	<i>Juncus balticus</i>
Cattail	<i>Typha spp.</i>
Coyote brush	<i>Baccharis pilularis</i>
Curly dock	<i>Rumex crispus</i>
Fat hen	<i>Atriplex patula</i>
Pickleweed	<i>Salicornia virginica</i>
Saltgrass	<i>Distichlis spicata</i>
Wild radish	<i>Raphanus raphanistrum</i>

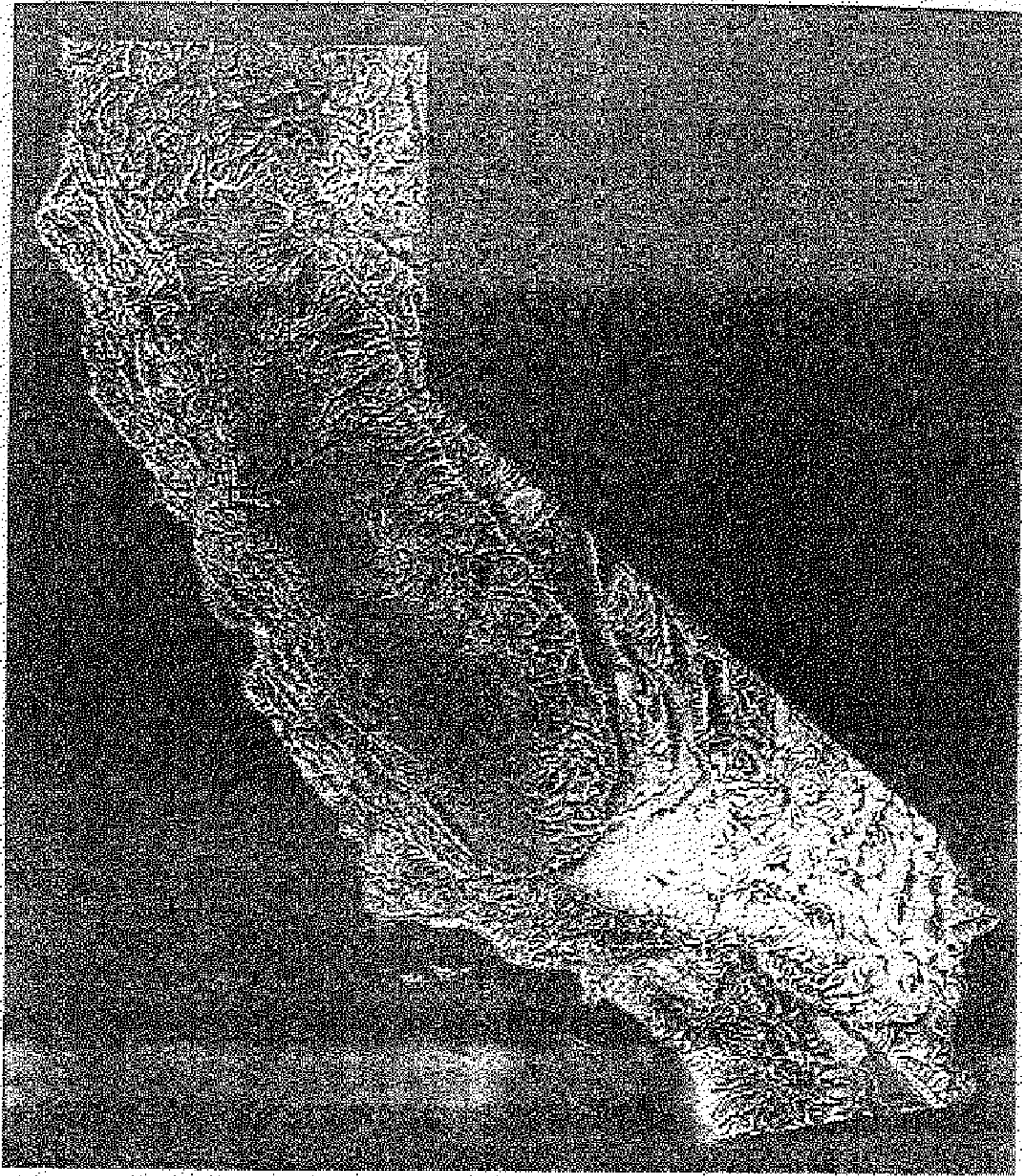


Figure 1

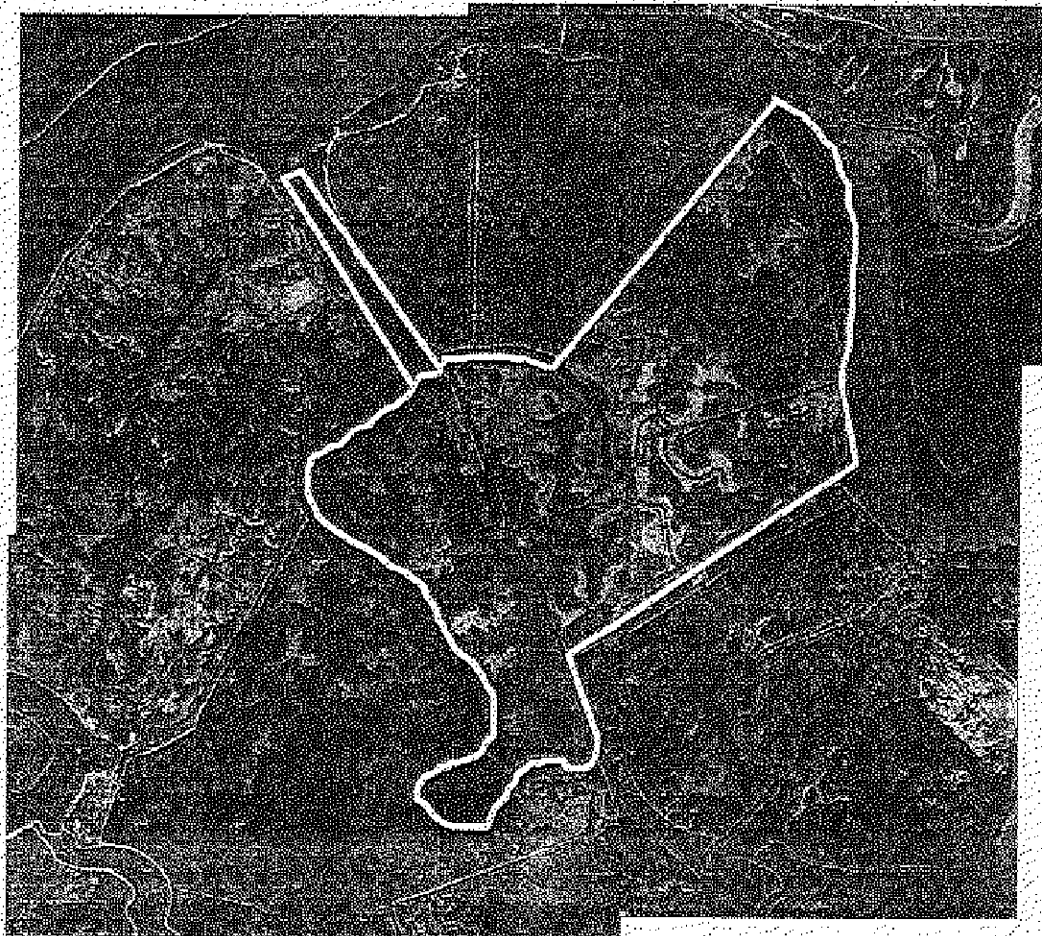


Figure 2

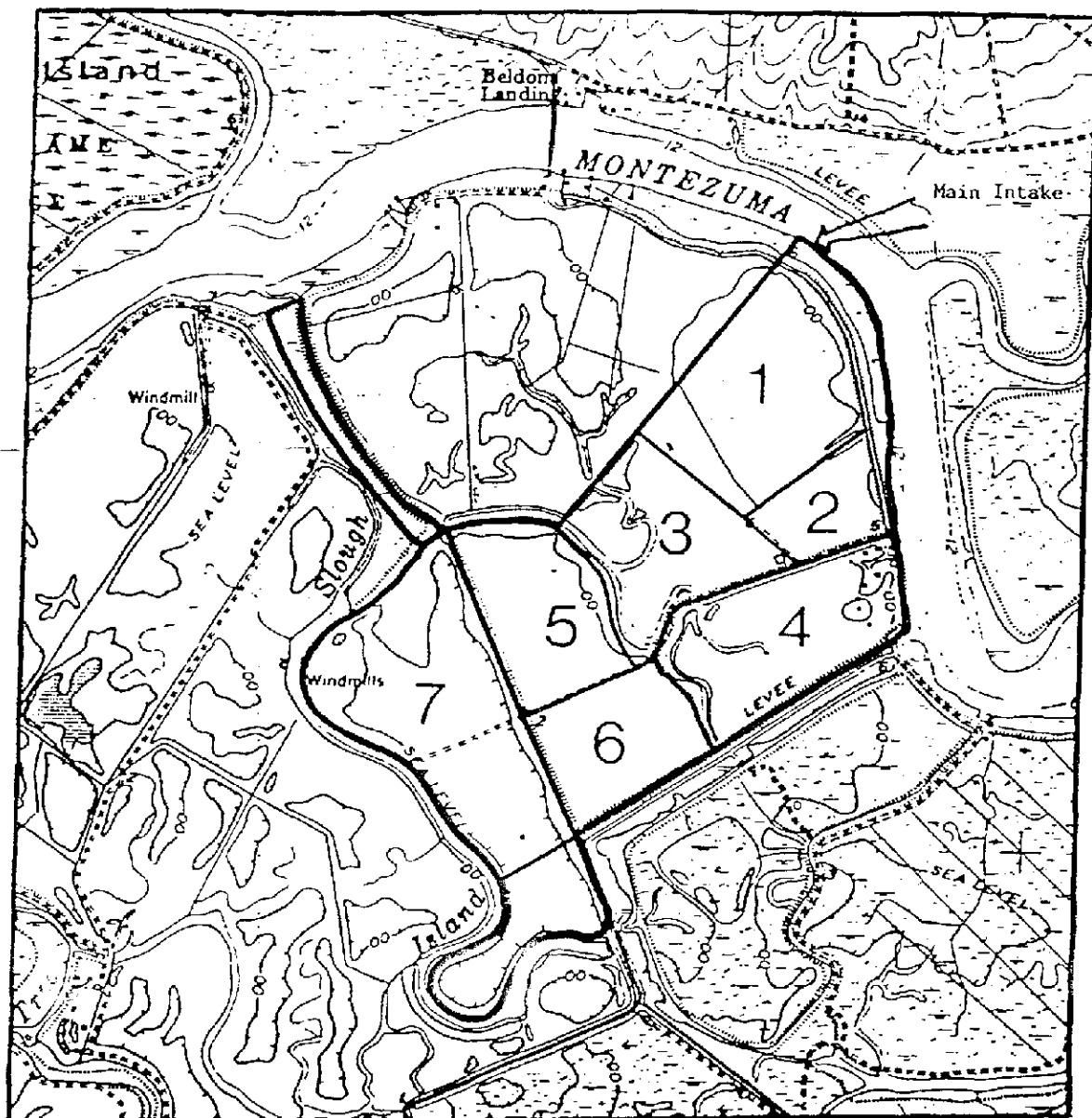


Figure 3 Island Slough Wetland Development Project. Area Levees, Ditches and Proposed Cells.

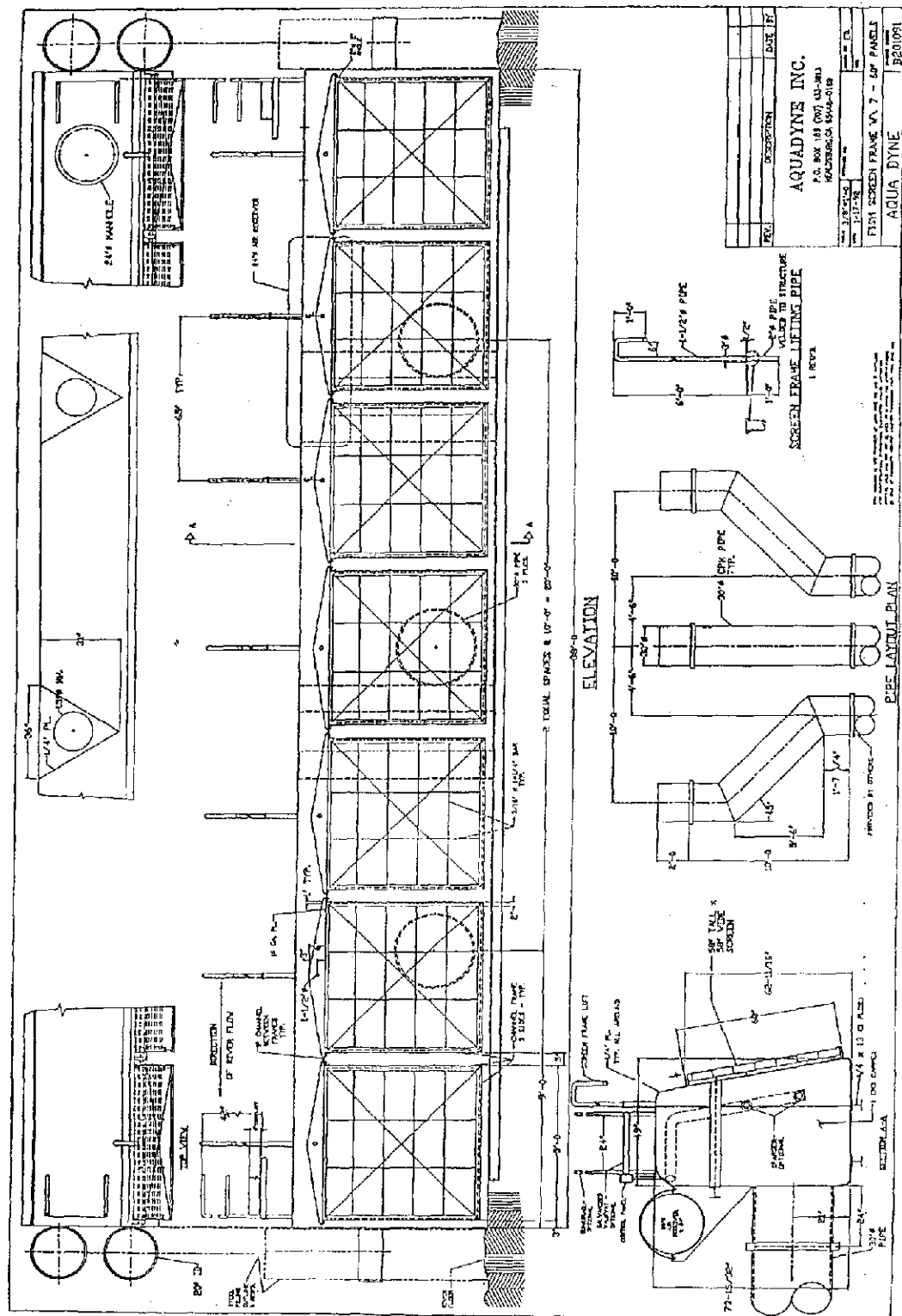


Figure 4